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Test 916: John Deere 2510 Syncro-Range Diesel

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NEBRASKA TRACTOR TEST 916 - JOHN DEERE 2510 SYNCRO-RANGE DIESEL

POWER TAKE-OFF PERFORMANCE

Hp	Crank- shaft speed rpm	Fuel Consumption		Hp-hr per gal	Temperature Degrees F			Barometer inches of Mercury
		Gal per hr	Lb per hp-hr		Cooling medium	Air wet bulb	Air dry bulb	
MAXIMUM POWER AND FUEL CONSUMPTION								
Rated Engine Speed—Two Hours								
* 54.96	2500	3.470	0.437	15.84	179	60	76	28.993
Standard Power Take-off Speed (1000 rpm)—One Hour								
49.24	2072	2.997	0.421	16.43	179	61	76	29.010
VARYING POWER AND FUEL CONSUMPTION—TWO HOURS								
48.08	2573	3.160	0.455	15.22	177	62	76	.....
0.00	2653	1.118	.....	.....	147	62	77	.....
24.56	2627	2.077	0.585	11.82	167	62	77	.....
54.64	2500	3.434	0.435	15.91	179	63	78	.....
12.32	2640	1.569	0.881	7.85	160	63	79	.....
36.44	2599	2.614	0.496	13.94	176	62	80	.....
Av 29.34	2599	2.329	0.549	12.60	168	62	78	29.033

DRAWBAR PERFORMANCE

Hp	Draw- bar pull lbs	Speed miles per hr	Crank- shaft speed rpm	Slip of drivers %	Fuel Consumption			Temp Degrees F				Barom- eter inches of Mercury
					Gal per hr	Lb per hp-hr	Hp-hr per gal	Cool- ing med	Air wet bulb	Air dry bulb		
VARYING DRAWBAR POWER AND FUEL CONSUMPTION WITH BALLAST												
Maximum Available Power—Two Hours—4th Gear												
46.82	3966	4.43	2506	6.55	3.407	0.504	13.74	182	60	67	28.905	
75% of Pull at Maximum Power—Ten Hours—4th Gear												
38.71	3129	4.64	2575	4.66	2.918	0.522	13.27	181	56	66	28.702	
50% of Pull at Maximum Power—Two Hours—4th Gear												
26.40	2081	4.76	2604	3.32	2.374	0.622	11.12	176	63	71	28.855	
MAXIMUM POWER WITH BALLAST												
44.46	6761	2.47	2564	14.75	2nd Gear			182	52	53	28.900	
48.39	5409	3.35	2505	9.04	3rd Gear			185	52	53	28.900	
48.92	4152	4.42	2499	6.42	4th Gear			186	52	53	28.900	
48.22	3302	5.48	2498	5.15	5th Gear			180	52	54	28.910	
47.52	2393	7.45	2498	3.71	6th Gear			180	52	54	28.910	
45.95	1835	9.39	2504	3.08	7th Gear			181	56	60	28.890	
MAXIMUM POWER WITHOUT BALLAST												
47.11	4171	4.24	2502	10.97	4th Gear			179	54	62	28.560	

VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST—4th Gear

Pounds pull	4152	4351	4539	4719	4859	4818
Horsepower	48.92	46.13	42.27	38.32	33.62	27.78
Crankshaft speed, rpm	2499	2259	1992	1743	1492	1241
Miles per hour	4.42	3.98	3.49	3.05	2.59	2.16
Slip of drivers, %	6.42	6.81	7.07	7.59	7.97	7.84

TIRES, BALLAST and WEIGHT

		With Ballast	Without Ballast
Rear tires	—No, size, ply & psi	Two 13.6-38; 6; 18	Two 13.6-38; 6; 14
Ballast	—Liquid	570 lb each	None
	Cast iron	435 lb each	None
Front tires	—No, size, ply & psi	Two 6.00-16; 6; 28	Two 6.00-16; 6; 32
Ballast	—Liquid	None	None
	Cast iron	None	None
Height of drawbar		17½ inches	18 inches
Static weight	—Rear	6520 lb	4510 lb
	Front	1790 lb	1840 lb
Total weight with operator		8485 lb	6525 lb

Department of Agricultural Engineering

Dates of Test: SEPTEMBER 30 TO OCTOBER 7, 1965

Manufacturer: JOHN DEERE WATERLOO TRACTOR WORKS, WATERLOO, IOWA

FUEL, OIL and TIME Fuel No. 2 diesel Cetane No 57.0 (rating taken from oil company's typical inspection data) Specific gravity converted to 60°/60° 0.8312 Weight per gallon 6.920 lb Oil SAE 20-20W API service classification MS, DM To motor 1.377 gal Drained from motor 1.456 gal Transmission and final-drive lubricant John Deere Special 303 oil Total time engine was operated 42½ hours.

ENGINE Make John Deere diesel Type 4 cylinder vertical Serial No SNM53RA012724T Crankshaft mounted lengthwise Rated rpm 2500 Bore and stroke 3.86" x 4.33" Compression ratio 16.3 to 1 Displacement 202.68 cu in Cranking system 12 volt electric Lubrication pressure Air cleaner oil washed wire screen Oil filter replaceable pleated paper cartridge Oil cooler radiator for transmission and hydraulic oil Fuel filter screens in fuel pump and injection pump and replaceable treated paper element Muffler was used Cooling medium temperature control thermostat.

CHASSIS Type tricycle Serial No SNT713-R001016R Tread width rear 57" to 91" front 8¾" or 18½" Wheel base 90" Center of gravity (without operator or ballast, with minimum tread, with fuel tank filled and tractor serviced for operation) Horizontal distance forward from center-line of rear wheels 28.6" Vertical distance above roadway 35.1" Horizontal distance from center of rear wheel tread 0" to the right/left Hydraulic control system direct engine drive Transmission selective gear fixed ratio with partial range synchro-mesh Advertised speeds mph first 1.78 second 2.80 third 3.65 fourth 4.69 fifth 5.73 sixth 7.69 seventh 9.62 eighth 15.76 reverse (at 2100 rpm) first 2.98 second 4.68 Clutch single plate dry disc operated by foot pedal Brakes wet disc hydraulically power actuated operated by two foot pedals which can be locked together Steering hydraulic with power assist Turning radius (on concrete surface with brake applied) right 103½" left 103½" (on concrete surface without brake) right 125" left 125" Turning space diameter (on concrete surface with brake applied) right 243½" left 243½" (on concrete surface without brake) right 287" left 287" Belt pulley 976 rpm at 2100 engine rpm diam 12" face 8½" Belt speed 3063 fpm Power take-off 546 or 1014 rpm at 2100 engine rpm.

REPAIRS and ADJUSTMENTS No repairs or adjustments.

REMARKS All test results were determined from observed data obtained in accordance with the SAE and ASAE test code.

First gear was not run as it was necessary to limit the pull in second gear to avoid excessive wheel slippage. Eighth gear was not run as it exceeded 15 mph.

The normal procedure used to determine oil consumption during official test gave questionable results on this engine. An anti-drain feature incorporated within the oil filter cartridge did not function consistently.

We, the undersigned, certify that this is a true and correct report of official Tractor Test 916.

L. F. LARSEN

Engineer-in-Charge

G. W. STEINBRUEGGE, Chairman

J. J. SULEK

D. E. LANE

Board of Tractor Test Engineers

The University of Nebraska Agricultural Experiment Station
E. F. Frolik, Dean; H. H. Kramer, Director, Lincoln, Nebraska

EXPLANATION OF TEST REPORT

GENERAL CONDITIONS

Each tractor is a production model equipped for common usage. Power consuming accessories can be disconnected only when it is convenient for the operator to do so in practice. Additional weight can be added as ballast if the manufacturer regularly supplies it for sale. The static tire loads and the inflation pressures must conform to recommendations in the Tire Standards published by the Society of Automotive Engineers.

PREPARATION FOR PERFORMANCE RUNS

The engine crankcase is drained and refilled with a measured amount of new oil conforming to specifications in the operators manual. The fuel used and the maintenance operations must also conform to the published information delivered with the tractor. The tractor is then limbered-up for 12 hours on drawbar work in accordance with the manufacturer's published recommendations. The manufacturer's representative is present to make appropriate decisions regarding mechanical adjustments.

The tractor is equipped with approximately the amount of added ballast that is used during maximum drawbar tests. The tire tread-bar height must be at least 65% of new tread height prior to the maximum power run.

BELT OR POWER TAKE-OFF PERFORMANCE

Maximum Power and Fuel Consumption. The manufacturer's representative makes carburetor, fuel pump, ignition and governor control settings which remain unchanged throughout all subsequent runs. The governor and the manually operated governor control lever is set to provide the high-idle speed specified by the manufacturer for maximum power. Maximum power is measured by connecting the belt pulley or the power take-off to a dynamometer. The dynamometer load is then gradually increased until the engine is operating at the rated speed specified by the manufacturer for maximum power. The corresponding fuel consumption is measured.

Varying Power and Fuel Consumption. Six different horsepower levels are used to show corresponding fuel consumption rates and how the governor causes the engine to react to the following changes in dynamometer load: 85% of the dynamometer torque at maximum power; minimum dynamometer torque, $\frac{1}{2}$ of the 85% torque; maximum power, $\frac{1}{4}$ and $\frac{3}{4}$ of the 85% torque. Since a tractor is generally subjected to varying loads the average of the results in this test serve well for predicting the fuel consumption of a tractor in general usage.

DRAWBAR PERFORMANCE

All engine adjustments are the same as those used in the belt or power take-off tests. If the manufacturer specifies a different rated crankshaft speed for drawbar operations, then the position of the manually operated governor control is changed to provide the high-idle speed specified by the manufacturer in the operating instructions.

Varying Power and Fuel Consumption With Ballast. The varying power runs are made to show the effect of speed-control devices (engine, governor, automatic trans-

mission, etc.) on horsepower, speed and fuel consumption. These runs are made around the entire test course which has two 180 degree turns with a minimum radius of 50 feet. The drawbar pull is set at 3 different levels as follows: (1) as near to the pull at maximum power as possible and still have the tractor maintain the travel speed at maximum horsepower on the straight sections of the test course; (2) 75% of the pull at maximum power; and (3) 50% of the pull at maximum power. Prior to 1958, fuel consumption data (10 hour test) were shown only for the pull obtained at maximum power for tractors having torque converters and at 75% of the pull obtained at maximum power for gear-type tractors.

Maximum Power with Ballast. Maximum power is measured on straight level sections of the test course. Data are shown for not more than 12 different gears or travel speeds. Some gears or travel speeds may be omitted because of high slippage of the traction members or because the travel speed may exceed the safe-limit for the test course. The maximum safe speed for the Nebraska Test Course has been set at 15 miles per hour. The slippage limits have been set at 15% and 7% for pneumatic tires and steel tracks or lugs, respectively. Higher slippage gives widely varying results.

Maximum Power Without Ballast. All added ballast is removed from the tractor. The maximum drawbar power of the tractor is determined by the same procedure used for getting maximum power with ballast. The gear (or travel speed) is the same as that used in the 10-hour test.

Varying Power and Travel Speed with Ballast. Travel speeds corresponding to drawbar pulls beyond the maximum power range are obtained to show the "lugging ability" of the tractor. The run starts with the pull at maximum power; then additional drawbar pull is applied to cause decreasing speeds. The run is ended by one of three conditions: (1) maximum pull is obtained, (2) the maximum slippage limit is reached, or (3) some other operating limit is reached.

For additional information about the Nebraska Tractor Tests write to the Department of Agricultural Engineering, University of Nebraska, Lincoln, Nebraska.



John Deere 2510 Syncro-Range Diesel